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Knots & Ropes for Amateur Radio

Tom Morgan ZS1AFS/ZT1T brings his sailing experience to bear, explaining the twists and turns of using knots and ropes in your antenna installations.

My wife, Susan, and I came into amateur radio in preparation for blue-water sailing. After many enjoyable years, amateur radio saved us when we were rescued in the South Atlantic. Since then, amateur radio in the cruising world has shrunk with the 'marina trek' and the dreaded 'exclusionist' rallies. With so-called progress, many yachts have satellite phones like Iridium.

When we came ashore we decided to build a new station in South Africa. We started with a multiband vertical on a corrugated metal roof. The station has since developed into what we have now – two towers with beams from 40m up to 10m. We brought to amateur radio our sailing experience of rigging as well as the use of ropes and knots. For the purists out there, I have not distinguished between hitches and bends.

With the development of Susan's flower garden I have to trapeze antennas from one tower to the other. Of course, Susan is the ground crew. But that's for another time.

Useful Knots

You don't want knots that slip so which ones are useful to radio amateurs? Most amateurs need to raise antennas. So, if you have a high fixing point on a wall, you need at least one pulley and a line (rope) running freely through it. If the point is on a tower, you need at least one at the top.

I added cleats to both of my towers so that the permanently rigged ropes would be secure, **Fig. 1**. Also, we have a cleat board, **Fig. 2**, that can be placed wherever it is needed. You can get 'bolt-on' cleats if you don't have a friendly welder. Failing that, the rolling hitch (later) can always be pressed into service. But what about the knots?

Bowline

For lifting any items with a becket (a loop of rope or similar device for securing loose items on a ship) or a hole at the top (like a tool bag or bucket with a handle) a loop made with a bowline is good. If you need to tie a line to an insulator, the bowline is just the one. Susan always leaves a long tail on the bowline so I can tie it to the tower at whatever height I'm working. (Some readers may remember the bowline from Scouting days – it's the one where 'the rabbit went through the hole'.) The sequence, **Figs. 3a** through **3d**, is shown because it's easy to forget if you only use it a few times. Susan and I have had to tie these, on deck and in the dark, many times! The photos, **Figs. 4** and **5** show the bowline in use to hold a bucket and to secure an antenna insulator.

Clove Hitch & Derivatives

Then we have the question, *"But what if I want to tie a rope to a rung or an upright?"* The easiest choice is the clove hitch. It should only be temporary unless backed up. I use a clove hitch on a rung for my trapeze line and secure the excess with a rolling hitch on a vertical under tension, to avoid any movement. You could add a half hitch to the clove hitch: that makes a midshipman's hitch. But it will still creep. Temporarily, I use a slip hitch, as in **Fig. 6**. The slip hitch is handy because it can be released while the knot is under tension – unlike the dreaded overhand knot. So, you want to stop the clove hitch from moving? Then the choice is the rolling hitch or the camel hitch. Both are variants of the clove hitch. See **Fig. 7**. The rolling hitch is a clove hitch but is started with two turns on the side where the pressure will come. It won't move in that direction under tension. Tip: the easiest way to use this knot is lay it up on the rigid support and then pull it along to tension it into position, rather than trying to do two turns with the rope under already-applied pressure.

I can hear some old salts and 'experts' questioning, *"What's a camel hitch?"* Well, it's a clove hitch with two turns on either side. It's an ancient knot developed in Arab countries for tethering camels to a ground line. They couldn't move in either direction. As you can see from Fig. 7, the

Fig. 1: Rope secured to a cleat.

Fig. 2: Cleat board.

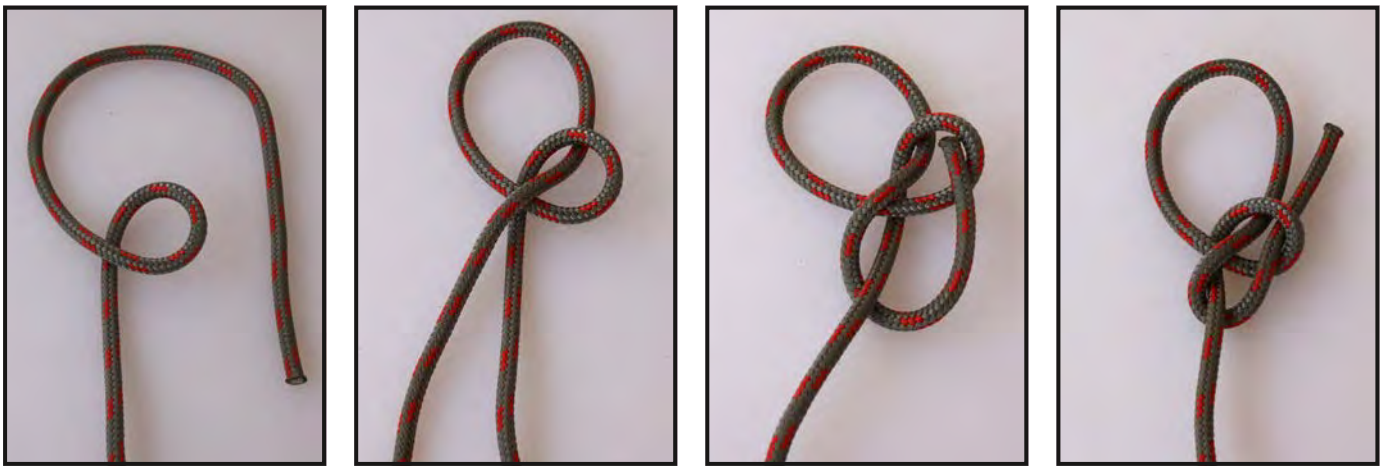

Fig. 3: The stages of tying a bowline.

standing part and the loose tail come out near the middle. A neat way to make it more permanent is a cable tie fixing both parts. This knot in 10mm plaited rope will be able to take the weight of a couple of radio amateurs. Of course, a proper harness should be worn.

Sheet Bend & Double Sheet Bend

What if the lengths you could buy were not long enough? You can join them. No, you should never use a reef knot because it works on equal tension from both sides. And, of course, we all know the granny knot is useless. So, what should we use? The Sheet Bend or the Double Sheet Bend is best. These can be used with ropes of differing or the same thickness. Always make the 'loop' from the thickest. I know there are other knots but these will do. Sheet bends are so-called because they were developed to hold the corners of sails (sheets) that were inaccessible when the sail was filled with wind. Only when the sail was furled to the boom could the clew (corner) of the sail be reached (think square riggers). From the photo, **Fig. 8**, it is obvious how both knots are made. But do remember to have a long tail (loose end). One tip is to keep hold of the 'loop' because this will avoid the sheet bend from collapsing until you can pull the tail alongside the thinner rope.

For security, and if the join sits at a normally inaccessible point, we use a double sheet bend. This is the knot for flag halliards that tightens under strain in wind and vibration and will not creep.

Ropes

Before dealing with suitability of types of rope, one factor is paramount - the 'Safe Working Load'. Bridon Fibre Ropes give the breaking strain of 12mm plaited diameter DYNAMICA (Dyneema) as 17800kg. Working on a generous 50% safety factor gives a safe working load (SWL) of 8900kg. Knots can also reduce SWL. But that should be well within the SWL needed by most radio amateurs.

Traditionally, most rope for general purpose was laid up clockwise in three strands, hence laid rope. Modern rope is plaited and called braided rope. Usually, there is an inner core and an outer plaited sheath that is hardwearing and resistant to chafe. Hence, we have braided rope. DYNAMICA ropes are coated to increase abrasion resistance. These ropes are ten times as strong as steel wire of the same diameter!

Storing Ropes

The photo of the coiled ropes lined up on the security gate, **Fig. 9**, shows how they can be stored. I keep them in a Waitrose trolley bag with all the tower equipment. Coiled this way, see **Figs. 10a** through **c**, they can be laid out to uncoil as the antenna crosses the flower garden without knotting.

On board, we used to make up the skeins and then throw them into the stern locker. We disbanded the hook idea, for hanging, because they rubbed and wore with the movement of the yacht. If it is a really long braided rope, snaking it down into a bucket is tidiest. I know many cruising yachties who used pouches or solid containers to stow their longest warps. But these were over 12mm in diameter. Nowadays I have a couple of cloakroom hooks on the back of the radio room door to take thicker ropes, **Fig. 11**.

Where to Find Ropes

Now comes the important question,

Fig. 4: A bowline securing a bucket.

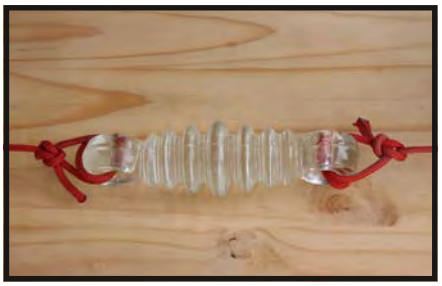

Fig. 5: A bowline to secure a rope to an antenna insulator.

Fig. 6: Slip hitch.

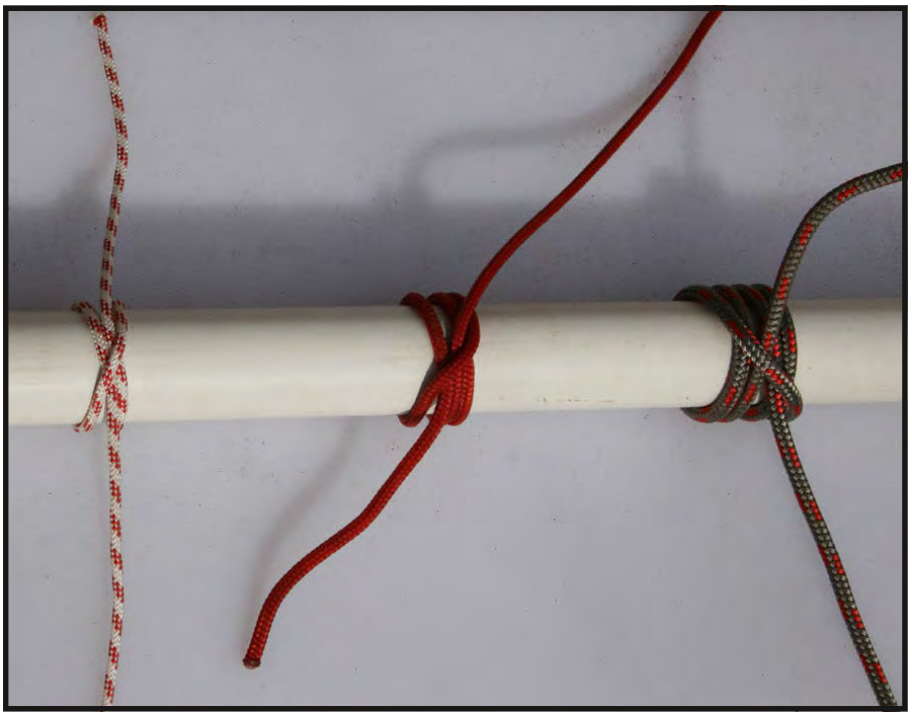

Fig. 7: Clove hitch, rolling hitch and camel hitch.

Fig. 9: Ropes stored on gate.

Fig. 8: Sheet bends – the double sheet bend is on top.

"Where is the best place to obtain ropes?" Those with sailing friends could have a constant source as ropes are replaced. Keen racing types will discard some ropes yearly! And for those near the sea there is the round of boat jumbles. If a friend is going to a boat show, ask him or her to pick up a bight for you. There are always traders selling suitable lengths cheaply. They come in lengths from 10m to 30m. As a rule of thumb, 8mm diameter is as thin as elderly amateurs can pull – 10mm is better. As described above, the strength of modern synthetic braided/plaited ropes is huge compared with the traditional three-strand laid rope.

Two aspects of rope that still need to be considered are stretch and UV-resistance. Rope made of polypropylene should be avoided because it fails on both counts. That's the blue, or orange, stuff that goes hairy and white in no time. That leaves you with nylon (and its derivatives) or a synthetic such as Terylene/Dacron or Dyneema. Nylon has some stretch and can absorb shocks – that's why it is used for small boat anchor warps. But for ropes that are resistant to stretch from constant wind on wire antennas and the like, the latter two may be preferred because they are harder wearing over a block (pulley). Manufacturers' advice on blocks is to use pulleys that are at least ten times the rope's diameter. This figure is related to sailing and the constant running of ropes over the pulley wheel under tension. For hoisting purposes this can be reduced by 50%. So, for a 10mm rope, a pulley with a wheel diameter of 50 to 60mm should be fine. But for permanent placement a larger block is recommended.

Why use Plaited Ropes?

Plaited rope should not kink. Yes, I know laid ropes are regularly available in the hardware store but they are often with little body and strength. Also, unlike when using plaited rope, knots have to take account of the lay of the strands. Unless it's a job lot from an unusual source, the laid rope will be clockwise. Being left-handed I have a natural tendency to tie knots as if the rope is laid counter clockwise.

We use a variety of ropes but for out-in-the-sun and strength we use Dyneema. This is expensive but our radio station is in a valley where it can reach 40°C+ during the summer and winds can get up to over gale force in the winter.

The photo, **Fig. 12**, of the Mosley

Fig. 10: Stages of rope coiling.

Fig. 11: Ropes stored on the back of the shack door.

TA-34XL with 40m extensions shows the 6mm Dyneema ropes (breaking strain 4000kg) that have been up five years. When lowered and inspected before Christmas 2017, the double sheet bends on the boom had not moved or worn. The ropes on the support rings are held up by bowline loops on thimbles and the tails (loose ends) are clamped to the standing parts using black (UV-resistant) cable ties.

Plaited ropes can be sealed with heat, cut straight across and the covering layers are hard and durable. All synthetic ropes for sailing are suitable for antenna work and they don't rot. The local boating or camping shop is another source.

When we needed to wash ropes, one tip came in handy. Before you put them in the washing machine, make sure they are made up in skeins. We put them in an old pillowcase, tied to avoid a tangle with the other washing.

Seizing an eye can avoid a big lump on the rope but, for brevity, this has not been covered in this article. The reader will have guessed the ubiquitous cable tie is an essential part of knots and ropes. Any questions? Please drop me an e-mail or see me at the National Hamfest in Lincoln (where rope can be bought).

And finally, just to show that it works, **Fig. 13** shows the author suspended by a rope. The top knot, **Fig. 14**, is a camel hitch on a vertical leg of his second tower. It will not slip. The homemade harness is attached with a loop tied with a bowline. Normally, I have multiple attachments when working on the tower. But that's another story …

Fig. 12: The author's Mosley TA-34XL antenna with 6mm ropes to provide rigidity.

Fig. 13: The author suspended in a fruit tree!

Fig. 14: The rope holding the author in the previous photo – a camel hitch around the leg of the second tower.